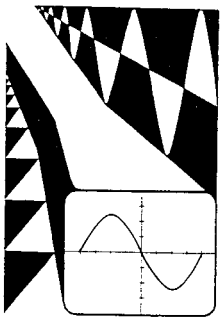
PHILIPS



Portable Storage ocsilloscope

PM 3266

Instruction Manual

9499 440 19702

781108

PHILIPS

CONTENTS

List of figures

INHALTS VERZEICHNIS (der Bedienungsanleitung)

TABLE DES MATIÉRES (notice d'emploi)

	Designation	*Specification*	*Additional Information*
1.2.2.	**Vertical or Y axis**		
1.2.2.1.	*Response (2mV range excepted)*	For 2 mV spec. see 1.2.2. 13.	35 MHz at 2 mV
	Frequency range	d.c. to 100 MHz a.c. 7 Hz to 100 MHz	–3 dB bandwidth d.c. coupled –3 dB bandwidth a.c.coupled frequency range includes 10:1 probe over 20-30 °C
	Rise-time	3,5 ns	
	Pulse aberrations	± 4% peak-peak	Over 6 divisions, +5 – 40°C
1.2.2.2.	*Deflection coefficient*	2 mV/div ... 5 V/div	(for 2 mV spec. refer to Section 1.2.2. 13.) Eleven calibrated positions in 1-2-5 sequence. Uncalibrated continuous control 1 : 2,5. Uncal. lamp signalling.
	Error limit	± 3%	Except linearity of CRT.
	Maximum permissible input voltage	± 400 V	d.c. + a.c. peak. Derating at frequencies above 500 kHz. See Fig. 1.2.
	Maximum undistorted deflection	24 divisions	Up to 35 MHz
	Shift range	16 divisions	8 divisions each in upward and downward direction from the central horizontal line of graticule.
1.2.2.3.	*Input impedance*	1 M Ω (± 2 %) // ≈ 15 pF	
	Input RC time	22 ms	Coupling to AC
1.2.2.4.	*Instability*		(for 2 mV/DIV setting refer to 1.2.2.13.).
	Instability of trace	0,1 div/hour	20-40 °C temperature range
	Trace jump	0,2 div	When switching between any of the attenuator positions
	Trace jump	0,5 div	When operating the NORM/INVERT switch
	Trace shift	0,2 div	When rotating the continuous attenuator 0,4 div in 5 mV setting
	Trace shift	1 div	When switching to the ADDED position. 0,4 div in 5 mV setting. Increasing when rotating the continuous attenuator.
1.2.2.5.	*Short-term temperature drift*	As 1.2.2.6.	
1.2.2.6.	*Long-term temperature drift*	20 μV/°C	Typical value
1.2.2.7.	*Visible signal delay*	15 ns approx.	
1.2.2.8.	*Display modes*	Channel + or – A only Channel + or – B only Trig. view only Channels ± A and ± B chopped Channels ± A and ± B alternated Channels ± A and ± B added ± A, ± B and Trig. view chopped or alternated (3 channels display)	If 3 channels display is selected in combination with alternate time-base display, this will be automatically displayed in main time-base intensified mode. Refer to 1.2.2.12. for full trig. view specification.

	Designation	*Specification*	*Additional Information*
1.2.2.9.	*Chopper frequency*	≈ 1 MHz	Display time per channel 350 ns approx.
1.2.2.10.	*Cross-talk between channels*	1:500	Up to 50 MHz With 8 divisions of signal amplitude on one channel, cross talk on other channel within line width, up to 35 Mc. Both attenuators in the same setting.
1.2.2.11.	*Common mode rejection factor*	Better than 100 up to 2 MHz 20 at 50 MHz	Measured with +A and −B added. Max. common-mode signal 8 divisions.
1.2.2.12.	*Trigger view display*	External or internal trigger signal.	
	Deflection coeff.	Same as vertical	
	External	100 mV/div ± 3 %	
	External ÷ 10	1 V/div ± 5 %	
	Internal	Vertical ± 10 %	
	Trigger point (threshold)	Screen centre ± 0,3 div	Coupling d.c.
	Aberrations	± 10 % peak-to-peak	
	Time delay between vertical input and external input	3 ns ± 1 ns	
	Bandwidth	80 MHz	Typical value
1.2.2.13.	*Specification of 2 mV/div setting*		
	a. Deflection coeff.	2 mV/div	
	Error limit	± 5 %	
	b. Response		
	Frequency range	DC 0 ... 35 MHz AC 7 Hz ... 35 MHz	−3 dB −3 dB
	Rise time	10 ns	
	Pulse aberration	± 5 % peak-to-peak	
	Common mode rejection factor	Better than 100 up to 2 MHz	
	c. Instability		
	Instability of trace	0,25 div/hour	20-40 °C temperature range
	Trace jump	1 div	When switching from 5 mV to 2 mV attenuator position
	Trace jump	2 div	When operating the Normal/Invert switch
	Trace shift	1 div	When rotating the continuous attenuator
	Trace shift	1 div	When switching to ADDED position

1. GENERAL INFORMATION

1.1. INTRODUCTION

The PM 3266 is a portable storage oscilloscope with a very high writing speed (1000 DIV/μs). The instrument enables the measurement of signals at a high sensitivity (2 mV/DIV) over an extensive bandwidth (100 MHz). The oscilloscope has been designed using a large number of integrated circuits, which guarantee very stable operation and reduce the number of adjusting points. As an aid to checking and adjusting, test points have been included at appropriate positions around the circuit. The instrument features various storage functions such as normal and fast writing speed and auto erasure.

There is a wide choice of display possibilities, such as one channel, two channels alternately or chopped, two channels added with normal and inverted positions for both input signals, and a main and delayed time-base. Additional features of the PM 3266 are the 3rd channel TRIG VIEW and ALTernate TB facilities.
TRIG VIEW enables the display of the trigger signal (internal or external applied) via a 3rd channel by push-button selection.
ALT.TB offers the instrument user a simultaneous display of the signal on the two time scale provided by the main time-base and the delayed time-base.
The PM 3266 oscilloscope features a tapless power supply that covers two voltage ranges, 90 V to 140 V and 200 V to 264 V by means of a switch, thus obviating the need for continuous adjustment to the local mains voltage.
All these features make the oscilloscope suitable for a wide range of applications.

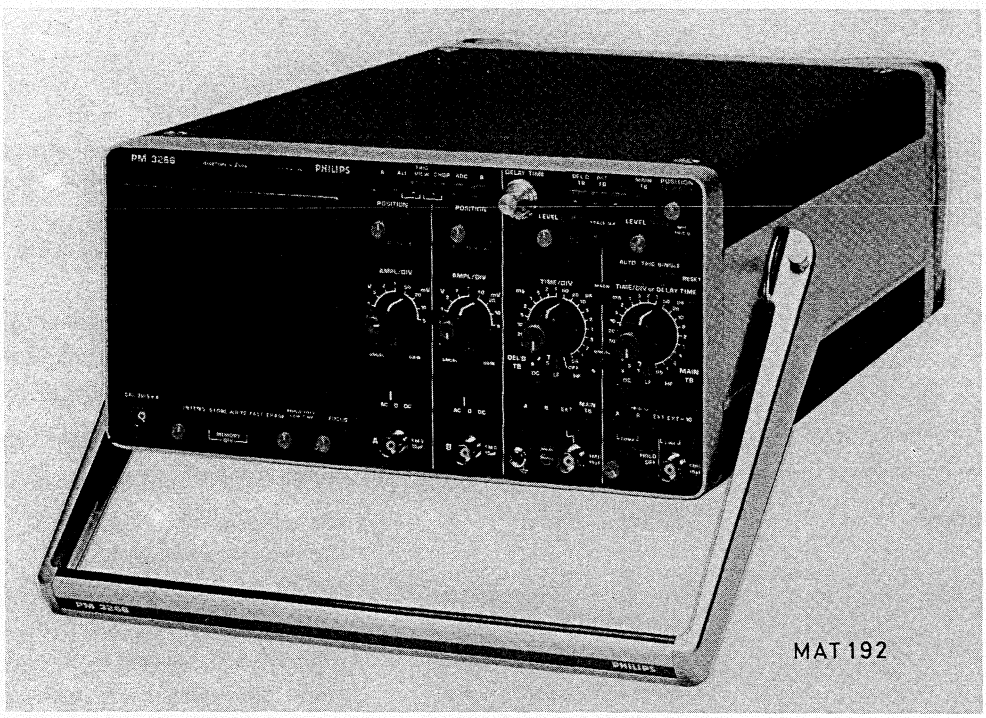


Fig. 1.1. Portable dual-trace Storage oscilloscope PM 3266

1.2. CHARACTERISTICS

This instrument has been designed and tested in accordance with IEC Publication 348 for Class 1 instruments and has been supplied in a safe condition. The present Instruction Manual contains information and warnings that shall be followed by the purchaser to ensure safe operation and to retain the instrument in a safe condition.

This specification is valid after the instrument has warmed up for 30 minutes.
Properties expressed in numerical values with tolerances stated, are guaranteed by the manufacturer.
Numerical values without tolerances are typical and represent the characteristics of an average instrument.

1.2.1. CRT section

Designation	*Specification*	*Additional information*
CRT type	PHILIPS L14-140GH/95	Storage tube with high writing speed, image transfer and scan magnification in vertical direction. Rectangular tube face, post accelerator and metal-backed phosphor.
Useful screen area	8 x 10 DIV	1 DIV equals 0,9 cm. Vertical and horizontal straight lines shall be presented as straight lines on the c.r.t. in the central 7 x 9 DIV screen area.
Screen type	P31 (GH) phosphor	
Total acceleration voltage	10 kV	
Graticule	Internal	Non-illuminated
Engravings	Dotted lines at 1, 5 and 6,5 DIV from top of display provide measuring lattice for checking of rise-time	
Writing speed	1000 DIV/μs	In FAST mode. Not guaranteed for the square areas of 2 by 2 divisions in each screen corner
	2,5 DIV/μs	In WRITE mode and MAX position
	0,25 DIV/μs	In WRITE mode
Storage time	1 hour max.	In STORE mode: dependent on the position of the INTENS (brightness) control
	60 sec.	In the WRITE mode at max. intensity
	15 sec.	In the MAX WRITE mode at max. intensity
	15 sec.	In the FAST mode at max. intensity.
Persistence	0,3 sec ... 1 min	Operative in WRITE MODE. Continuously variable.
Auto Erase	Operative in Fast mode with VIEW TIME control out of the MAX position. View time continuously variable between 3 and 8 sec.	In the auto-erase mode the following cycle occurs: the stored picture is erased. If the time-base is triggered a new picture is written. After the adjusted view time another cycle starts and the picture is erased, etc. In the FAST mode the AUTO, TRIG and SINGLE pushbuttons are inoperative. Their function is taken over by the storage unit.
Erase time	1,3 sec. in WRITE mode 1,6 sec. in FAST mode	These values represent the time between the release of the ERASE button and the end of the erase cycle. The erase button resets the main time-base.
Trace rotation	Screw-driver adjustment point	Accessible via one of the ventilation holes on the left-hand side of the instrument

	Designation	*Specification*	*Additional Information*
1.2.3.	**Horizontal or X Axis**		
1.2.3.1.	*Display modes*	– Main time-base – Main time-base intensified by delayed time-base – Delayed time-base – Main TB intensified and delayed TB alternately displayed. – X-Y and X-Y/Y operation	With possibility of trace separation of 4 divisions. X deflection by: – channel A signal – channel B signal – signal applied to EXT connector of main TB – line voltage
1.2.3.2.	*Horizontal position drift in X1 position*	0,2 div/hour	The horizontal position drift with the magnifier in the X1 position, shall not exceed 0,1 div/hour over 20-40 °C temperature range. The same stability requirement applies to the start of the sweep during variation of the sweep speed setting, with exception of highest sweep ranges (50-100 ns/div).
1.2.3.3.	*Horizontal position control*	± 5,2 div from screen centre	The horizontal shift control combines coarse and fine adjustment.
1.2.4.	**Main Time-base**		
1.2.4.1.	*Operation*	Automatic Triggered and single shot	Automatic free running in the absence of triggering signals, after less than 0,1 sec.
1.2.4.2.	*Time coefficient*	1 s/div ... 50 ns/div	23 calibrated positions in a 1-2-5 sequence Uncalibrated continuous control 1:>2,5 between the steps. One uncal. lamp for both MTB and DTB.
1.2.4.3.	*Coefficient error* The difference in sweep accuracy over any two div.	± 2 % ± 3 %	+20 °C ... +30 °C + 5 °C ... +40 °C The difference in sweep accuracy over any two divisions of 10 div sweep is ± 5 %, excluding the first and last div at the 5 ns and 10 ns magnified sweep rates.

	Designation	*Specification*	*Additional Information*
1.2.4.4.	*Expansion*		
	Magnification	10x	Switched, calibrated. The display when coinciding with the central horizontal graticule line shall not shift more than one div when the horizontal magnifier is changed from X1 to X10.
	Coefficient error	± 1 % additional	First and last 50 ns of 5 ns/div, 10 ns/div and 20 ns/div magnified sweep rates ± 5 %.
	Max. effective time coefficient	5 ns/div	
1.2.4.5.	*Variable hold-off time*	The sweep hold-off time can be increased by a factor of 10.	
1.2.5.	**Delayed Time base**		
1.2.5.1.	*Operation*	Delayed time-base starts optionally either immediately after the delay time, or upon arrival of the first trigger pulse after the delay time.	
1.2.5.2.	*Comparator long-term stability*	< 2 div at 1000 times magnification	With MTB at 1 ms/div and DTB at 1 µs/div a selected signal detail in the DTB mode shall not move more than two divisions after warm-up
1.2.5.3.	*Time coefficient*	0,5 s/div ... 50 ns/div	22 calibrated positions in 1-2-5 sequence Uncalibrated continuous control 1:2,5 between the steps. One uncal. lamp for both MTB and DTB.
1.2.5.4.	*Coefficient error*	± 2 % ± 3 %	+20 °C ... +30 °C + 5 °C ... +40 °C The difference in sweep accuracy over any two divisions of 10 div sweep is ± 5 %, excluding the first and last div at the 5 ns and 10 ns magnified sweep rates.

	Designation	*Specification*	*Additional Information*
1.2.5.5.	*Delay-time*	Continuously variable between 0x and 10x the time coefficient of the MTB	Calibrated. Range delay-time multiplier 0,00-9,99 Incremental accuracy 0,5 % typical 0,2 %.
1.2.5.6.	*Delay-time jitter*	1:20.000	
1.2.6.	**X Deflection**		
	X deflection via channel Y_A or Y_B	2 mV/div ... 5 V/div	Uncalibrated continuous control 1:2,5 via Y gain potentiometer.
1.2.6.1.	*Coefficient error*	± 5 %	
1.2.6.2.	*Bandwidth*	0 - 2 MHz	–3 dB bandwidth over 4 div.
1.2.6.3.	*Maximum undistorted delfection*	20 divisions	up to 100 kHz
1.2.6.4.	*Phase difference with respect to Y display*	3° at 100 kHz	
	External X-deflection via EXT socket		
1.2.6.5.	*Deflection coefficient*		
	External External ÷ 10	50 mV/div 500 mV/div	Uncalibrated continuous control 1:3
1.2.6.6.	*Accuracy*		
	External	± 3 %	Additional 2 % for Ext. :10
1.2.6.7.	*Bandwidth*	d.c. ... 2 MHz 7 Hz ... 2 MHz	Via DC trigg. coupling via LF or HF trigg. coupling
1.2.6.8.	*Input characteristics*	Identical to Y channels	
1.2.6.9.	*Phase difference Y-channels*	3° at 100 kHz	
1.2.6.10.	*Linearity*	1,5 %	
1.2.6.11.	*Drift*	0,2 div./hr.	
1.2.7.	**Triggering of the main time-base**		
1.2.7.1.	*Trigger source*	Internal from channel A Internal from channel B Composite A and B Internal from line External source External source ÷ 10	Alternate vertical mode only
1.2.7.2.	*Trigger modes*	Automatic	Automatic free-run of the time-base generator approx. 100 ms after disappearance of the trigger signal.
		Trigg. and single sweep	NOT TRIG'd lamp is illuminated after reset and extinguishes at the end of the sweep.
1.2.7.3.	*Slope*	+ or –	

	Designation	*Specification*	*Additional Information*
1.2.7.4.	*Trigger sensitivity*	Internal:0,5 div. upto 1,5 div. at 100 MHz	Typical sensitivity as a function of frequency. see Fig. 1.3.
		External: 50 mV upto 150 mV at 100 MHz	Typical sensitivity as a function of frequency, see Fig. 1.3.
		External÷ 10 : 500 mV	
1.2.7.5.	*Trigger modes and coupling*	DC: 0 - full bandwidth LF int: 0 - 30 kHz LF ext: 7 Hz - 30 kHz HF: 30 kHz - 100 MHz AUTO: 20 Hz - full bandwidth	Both internal and external –3 dB –3 dB –3 dB, both internal and external
1.2.7.6.	*Level range*		
	internal trigg. external trigg. external :10	24 DIV +1,2 V to –1,2 V +12 V to –12 V	
1.2.7.7.	*Input characteristics*	1MΩ (± 2%) //≈ 15pF	
1.2.7.8.	*Trigger jitter*	Better than 0,5 ns	
1.2.8.	**Triggering of the delayed time-base**		
1.2.8.1.	*Source*	Internal from channel A Internal from channel B External	Other characteristics are identical to TRIGGERING OF THE MAIN-TIME BASE. Except Ext. :10 and line trigg.
1.2.9.	**Calibration unit**		
1.2.9.1.	*Output voltage*	3 V_{p-p}	
1.2.9.2.	*Output current*	6 mA	
1.2.9.3.	*Error limit*	± 1 %	Both voltage and current
1.2.9.4.	*Frequency*	2 kHz ± 2 %	
1.2.9.5.	*Protection*	The output is protected against continuous short-circuiting.	
1.2.10.	**Additional Input and Outputs**		
1.2.10.1.	*Z-modulation*	DC coupled TTL compatible Positive polarity Blanks display response time 35 ns input impedance 10 kΩ max. input voltage 50 V	
1.2.10.2.	*Main TB Gate*	0 ... +5 V delivered during MTB sweep	Optionally available Output impedance 1 KOhm.
1.2.10.3.	*Delayed TB Gate*	0 ... +5 V delivered during DTB sweep	Optionally available Output impedance 1 KOhm

	Designation	*Specification*	*Additional Information*
1.2.11.	**Power supply**		
1.2.11.1.	*Line voltage*	90...140 Va.c. 200...264 Va.c. 250...350 Vd.c.	Automatically protected against incorrect setting of line selector
1.2.11.2.	*Line frequency*	46 to 440 Hz	
1.2.11.3.	*Power consumption*	50 W	
1.2.11.4.	*Power transients*		Damage to the oscilloscope shall not occur under voltage and frequency transient conditions specified in MIL-T-28800.

1.2.12. Environmental characteristics

Note:

The characteristics are valid only if the instrument is checked in accordance with the official checking procedure. Details on these procedures and failure criteria are supplied on request by the PHILIPS-organisation in your country, or by N.V. PHILIPS' GLOEILAMPENFABRIEKEN, TEST AND MEASURING DEPARTMENT, EINDHOVEN, THE NETHERLANDS.

1.2.12.1. Temperature tests

In accordance with IEC 68 Ab and Bb.
Operation: −15 °C to +55 °C.
Operation within specification: +5 °C to +40 °C. Exceptions on tolerances to be indicated per spec. point.
Storage: −55 °C to +75 °C.

1.2.12.2. Altitude

In accordance with IEC 68-2-13 test M.
Operation: to 15.000 feet (5000 m)
Derating: 1 °C/1000 feet for the max. operating temperature
Storage: to 50.000 feet (17.000 m)

1.2.12.3. Shock

Operating: 30 g, half-sine, 11 ms duration, 2 shocks per axis per direction for a total of 12 shocks.

1.2.12.4. Vibration

Operating: 15 minutes along each of 3 axes.
0.025 inch p-p displacement (4 g at 55 Hz) with frequency varied from 10 Hz to 55 Hz to 10 Hz in one minute cycles.

1.2.12.5. Recovery

Operates within 30 minutes coming from −10 °C soak, going into room condition of 60 % R.H. at 20 °C.

1.2.12.6. Magnetic Shielding

In accordance with IEC 351 - 22.3.1.
A maximum deviation of 1 div.

1.2.12.7. Interference

VDE 0871 and 0875, störgrad K

1.2.13.	**Mechanical data**			
1.2.13.1.	*Dimensions*	Length Width Height	460 mm (16 1/4 in.) 316 mm (12 1/4 in.) 154 mm (6 1/8 in.)	Excluding controls, cover and feet
1.2.13.2.	*Weight*	10,9 kg (21 lbs)		

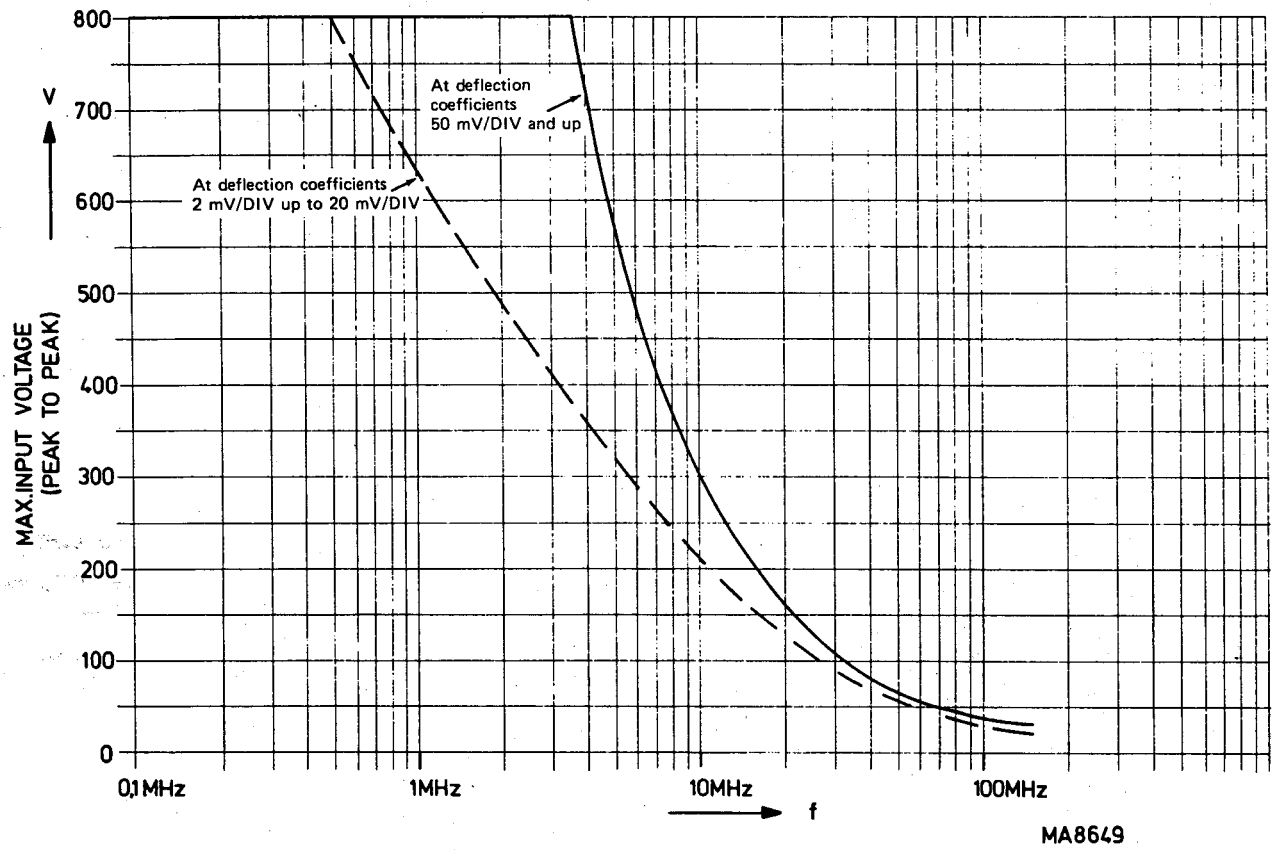


Fig. 1.2. Derating of the maximum permissible input voltage as a function of frequency

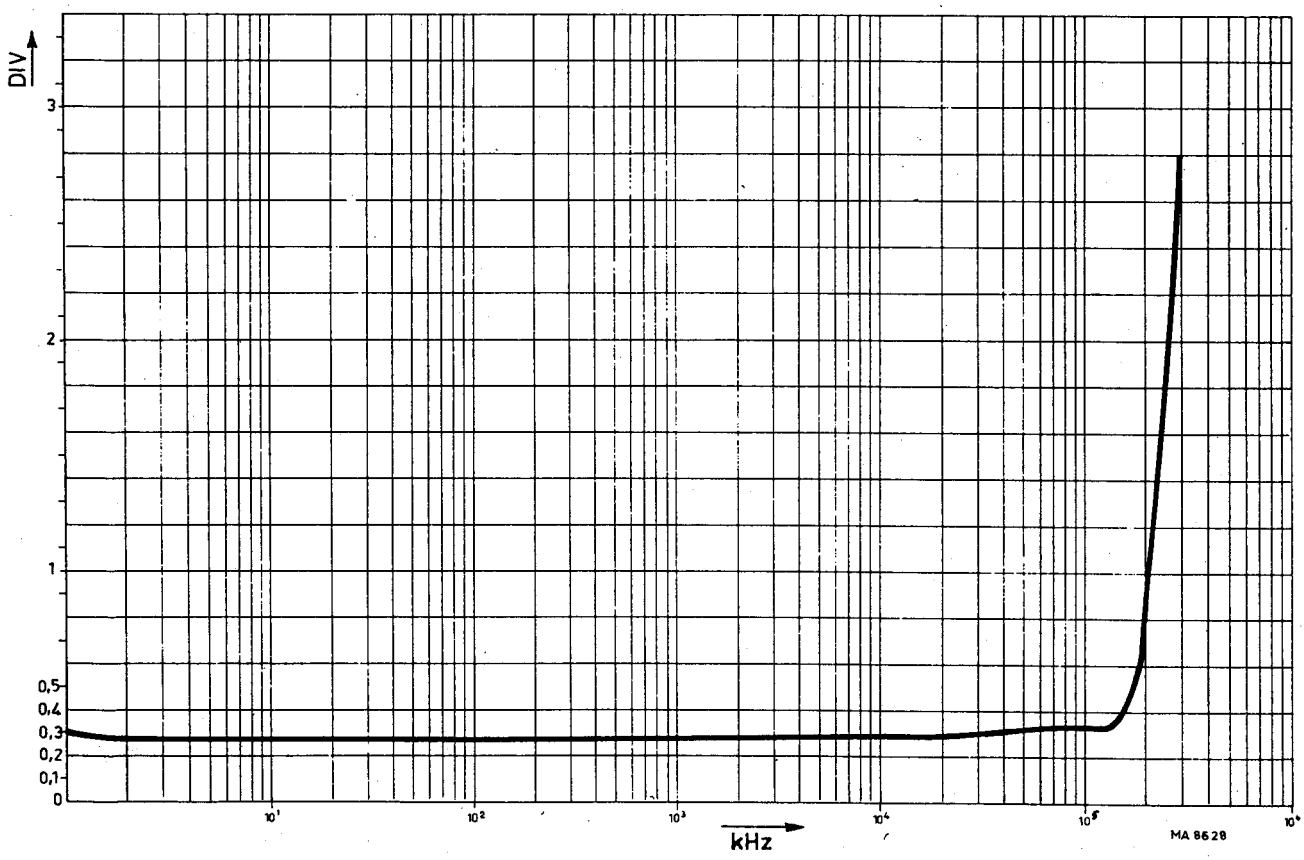


Fig. 1.3. Typical trigger sensitivity of channel A as a function of frequency

1.3. ACCESSORIES

1.3.1. Accessoires delivered with the instrument

- Two passive 10:1 probes
- Contrast filter
- Front cover with storage space
- Collapsible viewing hood (PM 9366)
- Banana - BNC adapter (PM 9051)
- CAL terminal - BNC adapter
- Manual

1.3.2. Optional accessoires

PM 8921	Passive probe set 1 : 1 (1.5 m)
PM 8921L	Passive probe set 1 : 1 (2.5 m)
PM 8935	HF passive probe set 10 : 1 (1.5 m)
PM 8935L	HF passive probe set 10 : 1 (2.5 m)
PM 8932	Passive probe set 100 : 1
PM 8994	Set of accessories for probes
PM 9353	Active FET probe 1 : 1; 10 : 1; 100 : 1; 3.5 pF (1.5 m)
PM 9355	Current probe: 1 mA/div ... 1 A/div.; 12 Hz ... 70 MHz
PM 9346	Power supply for active probes
PM 8960	19 inch rack mount adaptor
PM 8992	Accessory pouch
PM 9380	Oscilloscope camera
PM 8971	Adapter for oscilloscope camera
PM 8910	Polaroid anti-glare filter
PM 8980	Long type viewing hood
PM 8901	Battery pack 24 V d.c. and 280 V d.c.
PM 8991	Oscilloscope trolley
800/NTX	Trimming tool kit

Steinheil Oscillophot ® system: Oscilloscope camera's M3, M4 and M5 can be mounted on oscilloscope using Steinheil adapter 1820/50.

AC, 0, DC (S17, S18)	Signal input coupling; 3-way switch
AC position	Coupling via a blocking capacitor
0 position	Connection between input circuit and input socket is interrupted and the amplifier input is earthed to establish a reference.
DC position	Direct coupling With no button depressed, the circuit operates effectively as if the AC button is depressed, When viewing long duration pulses or d.c. levels of waveforms, the DC position should be selected. For a.c. waveforms with large d.c. levels, the AC position should be selected.
A, 1 MΩ//15 pF (X3)	BNC input socket for channel A.
B, 1 MΩ//15 pF (X4)	BNC input socket for channel B.

2.2.1.2. Horizontal channels

DEL'D TB, ALT TB, EXT X DEFL, MAIN TB (S2)	Horizontal displaymode or deflection controls; 4-way push-button switch.
DEL'D TB depressed	The horizontal deflection voltage is supplied by the delayed time-base generator.
ALT TB depressed	The horizontal display is switched over from the main time-base to the delayed time-base at the end of every cycle of the main time-base generator. Not functioning when TRIG VIEW is depressed or when the delayed time-base is switched to OFF.
EXT X DEFL depressed	Horizontal deflection is achieved by a signal applied to the external input socket (X7) of the horizontal amplifier, by the channel A or B signals, the composite signal, or by a mains-frequency (LINE) signal, depending on the TRIG or X DEFL push-button (S22) selection.
MAIN TB depressed	The horizontal deflection voltage is supplied by the main time-base generator. A part of the trace is intensified (except in the OFF position of the TIME/DIV switch of the delayed time-base generator). **No push-button depressed** is effectively the same as MAIN TB depressed.
POSITION TB MAGN (R2, S3)	Continuously variable control giving horizontal shift of the display; incorporates a push-pull switch for increasing the horizontal deflection coefficient by a factor of 10 (PULL FOR X10).
MAGN (V3)	A pilot lamp indicating that the X10 magnifier is in operation.
X-AMPL, HOLD-OFF (R18)	Continuously variable control of the horizontal deflection coefficients when using external X deflection. In the case of X deflection by the main time-base, this control can be used to increase the sweep hold-off time.
TRACE SEP. (R6);	Continuously variable preset control of the vertical space between the two time-base displays in the ALT TB mode.

2.2.1.3. Main time-base generator

LEVEL-SLOPE (R7, S7)	Continuously variable control for selecting the level of the triggering signal at which the time-base generator starts. This control incorporates a push-pull switch that enables choice of triggering on either the positive- or negative-going edge of the triggering signal (IN +, OUT −).
NOT TRIG'D (V2)	Pilot lamp indicating that the time-base generator is in the waiting position.

AUTO, TRIG, SINGLE (S8)	Trigger-mode controls; 3-way push-button switch.
AUTO depressed	The main time-base is free-running in the absence of trigger signals.
TRIG depressed	The time-base generator is normally triggered.
SINGLE depressed	After depressing the SINGLE button, the time-base generator runs only once upon receipt of a trigger pulse.
	If no button is depressed the circuit operates effectively as if the SINGLE mode has been selected.
TIME/DIV or DELAY TIME (S15)	Time coefficient control of the main time-base; 23-way rotary switch.
CAL (blue) - TIME/DIV (R11, S16)	Continuously variable control of the main time-base coefficients. In the CAL position the time coefficient is calibrated.
UNCAL (V6)	Pilot lamp indicating that the CAL control is not in the calibrated position.
DC, LF, HF (S20)	Trigger coupling; 3-way push-button switch.
DC depressed	Triggering signals are direct-coupled.
LF depressed	Trigger coupling via low-pass filter for frequencies up to 30 kHz (for external triggering via band-pass filter of 7 Hz to 30 kHz).
HF depressed	Trigger coupling via a high-pass filter for frequencies higher than 30 kHz. With no push-button depressed, the circuit operates effectively as with the DC button depressed.
TRIG or X-DEFL (S22)	Trigger source or external X deflection selector; 4-way push-button switch. X-deflection only when push-button EXT X DEFL of S2 (horizontal display-mode controls) is depressed.
A depressed	Internal triggering or X deflection signal derived from channel A.
B depressed	Internal triggering or X deflection signal derived from channel B.
COMP (A and B depressed simultaneously)	Internal triggering or X deflection signal derived from channels A and B.
EXT	Triggering on external signal connected to the adjacent 1 M - 15 pF socket (X7). When the EXT X DEFL button of the horizontal deflection controls is depressed, this socket is connected to the input of the horizontal amplifier.
EXT ÷ 10	EXT triggering or X deflection facilities as above, attenuated by a factor of ten.
LINE (EXT and EXT ÷ 10 depressed simultaneously)	Triggering or X deflection signal derived from an internal voltage at mains frequency. If no button is depressed, no mode is selected.
1 MΩ//15 pF (X7)	BNC socket for external triggering or horizontal deflection

2.2.1.4. Delayed time-base generator

DELAY TIME MULTIPLIER (R1)	Continuously variable control of the delay time, operating in conjunction with the TIME/DIV controls of the main time-base generator.
LEVEL-SLOPE (R5, S6)	Continuously variable control for selecting the level of the triggering signal at which the delayed time-base generator starts.

This control incorporates a push-pull switch that enables choice of triggering on the positive or negative-going edge of the triggering signal (IN +, OUT –).

TIME/DIV (S13)

Time-coefficient control of the delayed time-base; 23-way rotary switch.
Incorporates an OFF position whereby the delayed time-base is switched off.

CAL (blue) - TIME/DIV (R10, S14)

Continuously variable control of the delayed time-base generator time coefficients. In the CAL position the time coefficient is calibrated.

UNCAL (V6)

Pilot lamp indicating that the CAL control is not in the calibrated position.

DC, LF, HF (S19)

Trigger coupling; 3-way push-button switch.

DC depressed

Triggering signals are direct-coupled.

LF depressed

Trigger coupling via low-pass filter for frequencies up to 30 kHz (for external triggering via band-pass filter of 7 Hz to 30 kHz).

HF depressed

Trigger coupling via a high-pass filter for frequencies higher than 30 kHz.

With no push-button depressed, the circuit operates effectively as with the DC button depressed.

A, B, EXT, MAIN TB (S21)

Trigger source control and starting point of delayed time-base 4-way push-button switch.

A depressed

Internal triggering signal derived from channel A after delay time.

B depressed

Internal triggering signal derived from channel B after delay time.

EXT depressed

Triggering after delay time on an external signal connected to the adjacent 1 M - 15 pF socket.

MAIN TB depressed

Delayed time-base starts immediately after delay time.

With no button depressed, the circuit operates effectively as with the channel A button depressed.

1 MΩ//15 pF (X6)

BNC input socket for external triggering signals.

2.2.1.5. CRT display section

INTENS/POWER ON

Mains ON/OFF switch with LED indication if the instrument is switched on.
In the (MAX) WRITE, FAST or MEMORY OFF mode: the position of the knob determines the intensity of the waveform that is written on the storage layer of the c.r.t.
In the STORE mode: the position of the knob determines the brightness of the reproduced waveform on the c.r.t. screen.
If the brightness is increased the storage time decreases.

STORE/WRITE/FAST/ERASE (MEMORY OFF)

Pushbutton switches for the control of the storage system.

STORE

Enables recorded waveform to be stored for a longer time than available with the PERSISTENCE control. The INTENS control is operative.

WRITE

Enables waveform to be recorded at normal writing speed. The PERSISTENCE and INTENS controls are operative.

FAST	Enables waveform to be recorded at high writing speed. The VIEW TIME and INTENS controls are operative.
ERASE	Enables erasure of the waveform that is written on the storage layer of the c.r.t. This control is not effective in the STORE mode.
MEMORY OFF	If the STORE and WRITE pushbuttons are depressed together the memory function of the c.r.t. is switched off.

The instrument functions in the STORE mode in the event of a faulty pushbutton combination being selected.

PERSISTENCE/VIEW TIME	In the WRITE mode, this control enables a variable retention period for the recorded waveform (variable persistence). The MAX position gives an increase of the writing speed by a factor of approx. 10 times; in this position the c.r.t. shows some background illumination. In the FAST mode, automatic erasure followed by the recording of a new picture occurs after a certain time. This time is determined by the position of the VIEW TIME knob. In the MAX position of this knob, recording of a new picture occurs only after the ERASE button has been depressed. In this position the c.r.t. shows some background illumination.
FOCUS	Continuously variable control of the c.r.t. electron beam focusing in the horizontal direction. The vertical focusing is influenced by the INTENSity control. Therefore, the vertical focusing remains well-adjusted over nearly the whole INTENSity range. For the extreme positions of the INTENS control, the vertical focusing potentiometer is adjustable via a ventilation hole in the left-hand side of the instrument. The highest writing speed in the FAST mode is only obtained for optimum focusing of the electron beam.
TRACE ROT (R15);	Preset control for aligning the trace with the graticule line. Screw driver control on left-hand side of the instrument.

2.2.1.6. Miscellaneous

CAL (X1, X2)	Output socket providing a 2 kHz square-wave voltage of 3 Vp-p and a current of 6 mA for calibration purposes
⏚ (X5)	Measuring earth socket.
Z-MOD (X8) at rear side	Input socket for external Z-modulation.

2.2.2. Preliminary settings

As the following settings are identical for both vertical channels, only the procedure for channel A has been indicated.
Unless otherwise stated, the controls occupy the same position as in the previous adjusting procedure.

2.2.2.1. Adjusting the gain

- Operate push-button A of the display-mode controls (S1)
- Operate push-button A of the trigger-mode selector switch (S22)
- Operate push-button AUTO of the trigger-mode controls (S8)
- Operate push-button MAIN TB of the horizontal deflection controls (S2)
- Display the trace by means of the A POSITION control
- Set the INTENSity and FOCUS controls for a sharp, well-defined trace
  The controls not mentioned may occupy any position.
- Set the channel A AC-0-DC switch to DC
- Set the channel A AMPLitude switch to 0.5 V and the continuous control to CALibrated
- Connect the CALibration socket to the A input socket.
- Check that the trace height is exactly 6 divisions.
  If necessary, readjust the GAIN control on the front panel, immediately below the AMPLitude switch.

2.2.3. Inputs A and B and their possibilities

The oscilloscope has been provided with two identical channels, each of which can be used for either YT measurements in combination with one or both time-base generators, or XY measurements in combination with the external horizontal channel.

2.2.3.1. YT measurements

To display one signal, one of the two vertical channels can be selected by operating either push-button A or push-button B of the vertical display-mode controls.
When push-button ALT or CHOP is depressed, two different signals can be displayed simultaneously. The Y deflection coefficient and the polarity can be selected for each channel individually. When the ALT button is operated, the display is switched over from one channel to the other at the flyback of the time-base signal. Although the ALTERNATE mode can be used at all sweep speeds of the time-base generator, the CHOPPED mode will give a better display quality for long sweep times, because during these long sweep times the alternate display of the two input signals is clearly visible to the eye.

In the CHOPPED mode, the display is switched over from one channel to the other at a fixed frequency.
If push-button ADD of the display mode switch is operated, the signal voltages of both vertical channels are added. Depending on the positions of the polarity switches, either the sum or the difference of the input signals is displayed. The ADDED mode also enables differential measurements. With these measurements advantage is taken from the common mode rejection in the ADDED position. When the polarity switches of both channels are set to opposite positions, the common mode parts of the signals on sockets A and B will undergo a very slight amplification only, with respect to the differential mode parts.

2.2.3.2. XY measurements

If push-button EXT X DEFL of the horizontal display-mode selection controls and one of the TRIG OR X DEFL controls are operated, the time-base generator are switched off. If for example push button A of S22 is depressed, a signal applied to the vertical A channel is then used for horizontal deflection. The AC/0/DC switch and the step attenuator of channel A remain operative. Horizontal trace shift is possible with the X POSITION control and continuous control of the deflection coefficients with the A AMPL/DIV control.
Vertical channel B may also be used for X deflection.
To this end, the B button of the TRIG OR X DEFL controls is depressed.

It is also possible to use an internal voltage at the mains frequency or a signal applied to the EXT socket at the bottom right-hand side of the front panel for X deflection, after depressing the relevant push-button of the TRIG OR X DEFL controls. In the EXT and EXT ÷ 10 modes the trace width can be controlled with the X-AMPL/HOLD OFF potentiometer.
With this potentiometer in its CAL position, the deflection coefficient for external signals is 50 mV/DIV.
The external signal can be either d.c. or a.c. coupled (lower frequency limit 7 Hz) by depressing either the DC or the LF push-button of the trigger coupling controls of the main time-base.

2.2.3.3. *AC/0/DC switch*

The signals under observation are fed to input socket(s) A and/or B and the AC/0/DC switch is set to either AC or DC, depending upon the composition of the signal. As the vertical amplifier is d.c. coupled, the full bandwidth of the instrument is available and d.c. components are displayed as trace shifts in the DC position of the AC/0/DC switch.
This may be inconvenient when small signals superimposed on high d.c. voltages must be displayed. Any attenuation of the signal will also result in attenuation of the small a.c. component. The remedy is to use the AC position of the input switch, which employs a blocking capacitor, to suppress the d.c. and l.f. signals. Some pulse drop will occur when l.f. square wave signals are displayed.

The 0 position interrupts the signal and earths the amplifier input for quickly determining the 0 V level.

2.2.4. Triggering

If a signal must be displayed, the horizontal deflection must always be started on one fixed point of the signal in order to obtain a stationary display. The time-base generator is, therefore, started by narrow trigger pulses formed in the trigger unit and controlled by a signal originating from one of the vertical input signals, an internal voltage at mains frequency or an external source.

2.2.4.1. *Trigger coupling*

Three different trigger-coupling methods can be chosen with the DC/LF/HF switch. In the HF and LF positions, the transfer characteristic is limited.
In position DC the trigger signal is passed unchanged.
In position LF, a 0 Hz (7 Hz for external triggering) to 30 kHz band-pass filter is inserted. This position can be used to reduce interference from noise.
In position HF, a 30 kHz high-pass filter is inserted.
This position can be used to reduce interference from e.g. hum.

2.2.4.2. *Selecting the trigger source and setting the trigger level*

The trigger signal is obtained from channel A (button A depressed), channel B (button B depressed), the COMPosite A and B signals (buttons A and B simultaneously depressed), an external source (button EXT or EXT ÷ 10 depressed) or from an internal voltage at mains frequency (button EXT and EXT ÷ 10 depressed).
The trigger pulse shaper is a dual controlled multivibrator switched by the output signals of a differential amplifier.
The trigger signal, together with biasing voltages which are adjustable with the LEVEL potentiometer, fed to the inputs of the differential amplifier.
Depending on the LEVEL setting, a certain part of the trigger signal will be amplified by the differential amplifier.
The multivibrator is thus switched at a fixed point of the trigger signal (see Fig. 2.4.). This means that, with the aid of the LEVEL control, it is possible to scan the shape of the trigger signal (in case of internal triggering A or B equal to the shape of the signal to be displayed) and, thus, to choose the point where the multivibrator will be switched.
The LEVEL potentiometer is fitted with a push-pull switch which allows selection of the trigger slope.

2.2.4.3. *Automatic triggering*

When the AUTOmatic button of the AUTO-TRIG-SINGLE switch is operated, and if there are no trigger pulses available, the time-base generator is automatically free-running.
The trace is, therefore, always visible. The AUTOmatic mode can be used in all cases where also the TRIG mode is usable, except with signal frequencies lower than 10 Hz or pulse trains with an off time exceeding 100 ms.
As soon as trigger pulses are available, the free-running state of the time-base generator is automatically terminated and the time-base generator is triggered again as described in sections 2.2.4.1. and 2.2.4.2.
When the TRIGgered or SINGLE button is operated, the auto-circuit is switched off. The LEVEL setting can also be used in the AUTOmatic mode.

2.2.4.4. *SINGLE sweep triggering*

When effects which occur only once have to be observed (usually photographed), it is often desirable to ensure that only one sawtooth is generated, even though several trigger pulses might be produced after the phenomenon of interest. Of course, the single sawtooth in question must be triggered by a trigger pulse. To this end, the SINGLE button must be pressed. The first trigger pulse that appears after the button has been

released will start the time-base generator.
The time-base generator is then blocked until the SINGLE button is pressed again. The NOT TRIG'D lamp will light up as soon as the SINGLE button is depressed and remains lighting until the trigger pulse arrives.

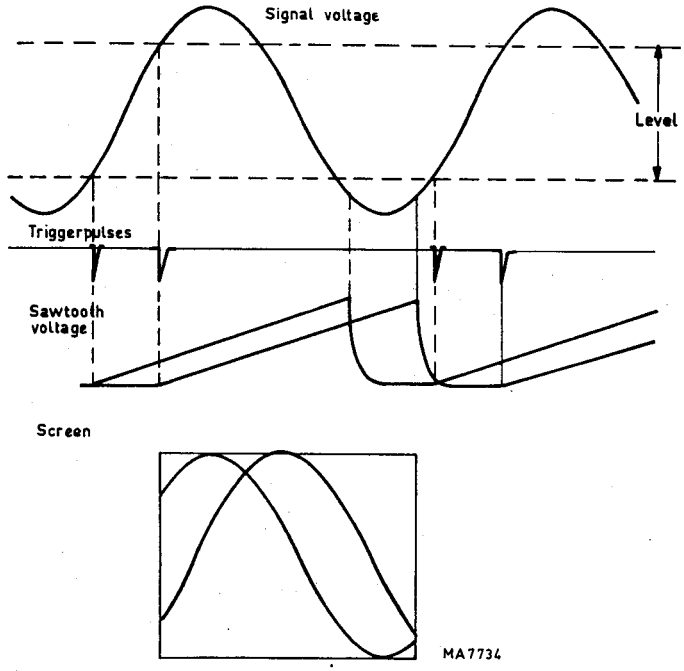


Fig. 2.4. Scanning the waveform by means of the LEVEL potentiometer

2.2.5. Time-base magnifier (R2/S3)

The time-base magnifier is operated by a push-pull switch incorporated in the horizontal-POSITION control If this switch is pulled to position x10, the sweep speed of the main time-base generator is increased by a factor of 10. Thus, the portion of the signal displayed over a width equal to one division in the centre of the screen in the x1 position (TB MAGNifier depressed), will occupy the full width of the screen in the x10 position.
Any portion of the trace can be brought on to the screen by the horizontal-POSITION control for scrutinisation. In the x10 position, the time coeffcient is determined by dividing the indicated TIME/DIV value by 10.

2.2.6. Use of the delayed time-base

The delayed time-base can be used for the accurate study of complex signals. When push-button MAIN TB of the delayed t.b. trigger-source controls (S21) is operated, immediately the delayed time-base is on (i.e. the TIME/DIV switch is not at OFF), a portion of the displayed signal is intensified in the MAIN TB position of the horizontal deflection controls (S2). The DELAY TIME control (R1) enables this intensified portion to be shifted along the time axis. The duration of the intensified portion, its length, can be controlled in steps and continuously by means of the TIME/DIV controls of the delayed time-base generator. When push-button DEL'D TB of the horizontal deflection controls (S2) is operated, the intensified portion occupies the full width of the screen. In the DEL'D TB position, the delay time, (i.e. the interval between the starting point of the main time-base and the starting point of the delayed time-base) is determined by the settings of the main TIME/DIV controls and the DELAY TIME control.

If one of the other del'd t.b. trigger-source controls (S21) is operated, the delayed time-base is started by the first trigger pulse that occurs after the selected delay time. This trigger pulse is supplied by the trigger unit of the delayed time-base generator. This position is used when time jitter would otherwise give a blurred image of the detail under observation. This time jitter could be part of the signal being investigated or, at extreme magnification, originate in the time-base circuits.

2.2.7. Use of the alternate time-base (S2)

The PM 3266 is equipped with display switching. This offers the instrument user a simultaneous display of the signal on the two time scales provided by the main time-base and by the delayed time-base.
Detailed examination of a certain portion of the main time-base display is enabled by expanding the time interval of interest by means of the delayed time-base. Expansion is achieved by selecting a correspondingly faster sweep for the delayed time-base TIME/div. control. Positioning of the time interval is set by the DELAY TIME potentiometer.

The part of the signal under detailed observation by the delayed time-base remains as an intensified portion of the main time-base display. This not only facilitates the location of the required detail during dialling but also serves as a visual indication of which portion of the overall trace is being examined. One can immediately correlate the detail with the overall signal, which may be extremely complex, without the necessity of switching between MAIN TB and DEL'D TB.

Vertical shift between the two time-base displays is continuously variable with the TRACE SEParation control (R6).

2.2.8. Use of the 3rd channel trigger view

2.2.8.1. External or Internal triggering

In many applications such as triggering with digital signals or signals of widely differing forms, it is necessary to use an external trigger source to ensure proper timing relationships and to know the time relationship of the trigger signal and the measuring signal(s). By depressing the TRIG VIEW push-button, the external trigger signal (fed to input socket X7) is displayed as a third channel with the threshold near the horizontal central graticule line. By adjusting the LEVEL/SLOPE (R7, S7) control, it is easy to determine which part of the trigger signal is initiating the sweep. This is also possible for signals internally derived from the A or B channel when push-button A or B of switch S22 is depressed.

The sensitivity control of the external trigger view mode has two steps, 50 mV/div and 0,5 V/div.
With the push-button switch EXT (S22) depressed the deflection factor is 100 mV/div which is compatible with ECL levels.
In the mode EXT ÷ 10 (S22) the deflection factor is 1 V/div which is compatible with TTL levels.

2.2.8.2. Single shot

With control LEVEL/SLOPE (R7, S7) the trigger level can be set at a predetermined value without the need of an input signal. This is of importance when the signal to be measured is not available in advance as when single events are under test. When input signals, which surpass a known threshold, have to be displayed, the trigger level (R7, S7) can be set in advance and an input signal of sufficient amplitude will initiate the time-base sweep.

The procedure to set the trigger level is as follows: Depress push-button TRIG VIEW.
Position the trace by means of the LEVEL (R7) control so many divisions in opposite direction (in relation to the horizontal central graticule line) as the trigger threshold is required.

Note: The trigger threshold is defined as the distance between the triggerpoint and the zero line of the amplifier (i.e. without input signals and deflection by means of POSITION controls).

2.2.9. Operation of the storage functions

MEMORY OFF mode

If the STORE and WRITE buttons are depressed the storage function is switched off and the instrument functions as a normal oscilloscope. In this mode, the INTENS knob controls the brightness of the displayed waveform. The FOCUS knob is used to obtain maximum sharpness of the display.
Blocking the memory system. If the instrument is waiting in the FAST mode (after the ERASE cycle has ended) for the time-base sweep, the instrument can only be put in the MEMORY OFF mode and not in the WRITE or STORE mode. The instrument can be put in the WRITE or STORE mode if the complete erase/write cycle of the FAST mode has been completed: in other words, only after the time-base has run and the image transfer has occurred.

WARNING: In the MEMORY OFF position, especially in the EXT X DEFL mode, excessive intensity for a prolonged period may damage the c.r.t.

WRITE mode

The waveform is recorded with normal writing speed. The position of the INTENS control determines the intensity of the waveform that is written on the storage layer of the c.r.t. Depending on the position of the PERSISTENCE control, a rapidly vanishing picture will be written on a green background (control entirely counter-clockwise) or a slowly vanishing trace on a black background (control adjacent to its first clockwise stop). The PERSISTENCE can be set to suppress any flickering when displaying a low frequency signal.
For a signal with a low repetition rate and a short rise-time the PERSISTENCE can be set so up to fill up the trace in order to obtain a clear and steady display.
The writing speed can be increased by a factor of approximately 10 by putting the PERSISTENCE control in the MAX position.

FAST mode

The waveform is recorded with high writing speed. The position of the INTENS control determines the intensity of the waveform that is written on the storage layer of the c.r.t. This mode is a single shot mode. If the VIEW TIME control is out of the MAX position the following cycle is repetitively performed. The stored picture is ereased and after that another picture is written when the time-base is triggered. After an adjustable viewing time the following cycle starts with the erasure of the c.r.t. screen. The viewing time is adjustable with the VIEW TIME control between 3 seconds (control entirely counter-clockwise) and 8 seconds (control adjacent to its first clockwise stop).
If the VIEW TIME knob is switched to the MAX position, recording of a new picture only occurs after the ERASE button has been depressed. In this mode it is also possible to transfer the instrument to the STORE mode after the time-base has run and a new picture is written.

For this function proceed as follows: put the instrument in the FAST mode and ERASE the picture. After this, the instrument will wait for a trigger signal. Now depress the STORE pushbutton and the instrument will transfer to the STORE mode after the new picture is written. To obtain a good quality picture, the waiting period for the trigger signal must not exceed one minute.

STORE mode

This mode enables storage of a recorded waveform for a longer time than is available on the PERSISTENCE control. The INTENS control is operative: with the control adjacent to its first counter-clockwise stop, a long storage time of approximately one hour is available.
The waveform is not visible in this position.
With the INTENS control turned entirely clockwise the storage time is short: for figures see the section 'Characteristics'. Here, the waveform is clearly visible. The ERASE pushbutton is not operative in the STORE mode.

ERASE FACILITY

When the trace is no longer required it can be erased by pushing the ERASE button (not operative in the STORE mode). Occasionally, the trace may not entirely disappear, especially those parts which were written with substantial brightness.
The remaining trace can be removed by prolonged actuation of the ERASE button.

1. ALLGEMEINES

1.1. EINLEITUNG

PM 3266 ist ein tragbares Speicher-Oszilloskop mit sehr hoher Schreibgeschwindigkeit (1000 Teil/μs). Das Gerät ermöglicht die Messung von Signalen bei sehr hoher Empfindlichkeit (2 mV/Teil) über eine grosse Bandbreite (100 MHz). Das Oszilloskop ist mit vielen integrierten Schaltungen bestückt wodurch sehr stabiler Betrieb gewährleistet ist und die Zahl der Einstellorgane verringert wird. Zur Erleichterung von Prüfung und Einstellung sind an geeigneten Stellen rund um die Schaltung Messpunkte vorgesehen. Das Gerät besitzt verschiedene Speicherfunktionen wie Normal- und Eilschreibgeschwindigkeit und automatische Löschung.
Die grosse Auswahl von Darstellungsmöglichkeiten umfasst: Darstellung eines Kanals, zwei Kanäle alternierend oder gechopped; zwei Kanäle addiert mit normaler und invertierter Lage für beide Eingangssignale sowie eine Hauptzeitbasis und eine verzögerte Zeitbasis.
Zusätzliche Besonderheiten des PM 3266 sind der dritte Kanal TRIG VIEW und die ALTernate TB (alternierende Zeitbasis) Möglichkeit.
TRIG VIEW gestattet Darstellung des Triggersignals (intern oder extern angelegt) über einen dritten Kanal durch Drucktastenwahl).
ALT.TB bietet dem Gebraucher eine gleichzeitige Darstellung des Signals auf den beiden von Hauptzeitbais und verzögerter Zeitbasis gelieferten Zeitmassstäben.
Das Oszilloskop PM 3266 hat eine Speisung mit niedriger Verlustleistung und lässt sich mittels eines Umschalters auf zwei Spannungsbereiche, nämlich 90 V bis 140 V und 200 V bis 264 V einstellen. Dadurch erübrigt sich innerhalb dieser beiden Bereiche die dauernde Einstellung auf die örtliche Netzspannung.
Durch alle diese Eigenschaften eignet sich das Oszilloskop für einen ausgebreiteten Einsatzbereich.

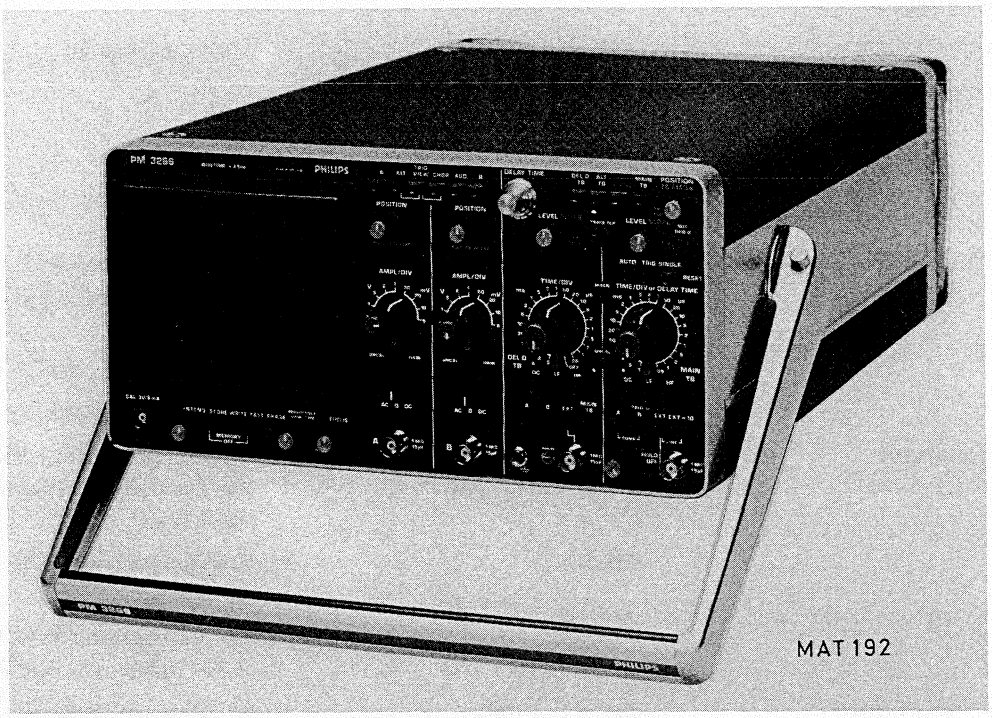


Abb. 1.1. Tragbares Zweistrahl-Speicher oszilloskop PM 3266

1.2. TECHNISCHE DATEN

Dieses Gerät ist gemäss IEC 348, Sicherheitsbestimmungen für elektrische Mess- und Regeleinrichtungen gebaut und geprüft und hat das Werk in sicherheitstechnisch einwandfreien Zustand verlassen. Um diesen Zustand zu erhalten und einen gefahrlosen Betrieb sicherzustellen, muss der Anwender der Hinweise und Warnvermerke beachten, die in dem vorliegenden Gerätehandbuch enthalten sind.

Nur Angaben mit Toleranzen oder Grenzwerten können als garantierte Daten angesehen werden. Daten ohne Toleranzen, d.h. ohne Fehlergrenzen, sind informative Daten und werden nicht garantiert.
Die Daten gelten nach einer Anwärmzeit von 30 Minuten nach dem Einschalten.
Prozentuale und absolute Fehler sind auf den jeweils angegebenen Referenzwert bezogen.

1.2.1. Bildteil

Benennung	Beschreibung	Näher Angaben
Elektronenstrahlröhre	Philips L14-140GH/95	Speicherröhre mit hoher Schreibgeschwindigkeit, Bildübertragung und Vergrösserung der vertikalen Ablenkempfindlichkeit, mittels eines elektronischen Linsensystem (scan magnification) Rechteckiger Schirm, Nachbeschleuniger und metallhinterlegter Leuchtschirm.
Ausnutzbare Schirmfläche	8 x 10 Teile	1 Teil = 0.9 cm. Vertikale und horizontale Linien müssen gerade sein im Zentralen 7 x 9 DIV Schirmgebiet.
Schirmtyp	P31 (GH) Phosphor	
Gesamte Beschleunigungsspannung	10 kV	
Raster	Intern	Nicht beleuchtet
Einteilung	Gestrichelte Linien bei 1,5 und 6,5 Teil vom oberen Bildschirm dienen als Messraste zur Prüfung der Anstiegszeit	
Schreibgeschwindigkeit	1000/Teil/µs	Bei Betriebsart FAST. Nicht garantiert für das Quadrat 2 x 2 Teil in jeder Schirmecke.
	2,5 Teil/µs	Bei Betriebsart Write und Stellung MAX
	0.25 Teil/µs	Bei Betriebsart WRITE
Speicherzeit	1 Stunde max.	Betriebsart STORE: Abhängig von der Stellung von Knopf INTENS (Helligkeit)
	60 Sek.	Bei Betriebsart WRITE (maximale Helligkeit)
	15 Sek.	Bei Betriebsarten MAX WRITE und FAST (maximale Helligkeit)
Nachleuchtdauer	0,3 S. . . 1 min.	Wirksam bei Betriebsart WRITE Stufenlos einstellbar